

Report for 2005GU61B: FSM atoll groundwater resource inventory.

Publications

- There are no reported publications resulting from this project.

Report Follows

PROJECT SYNOPSIS REPORT

Project Title: FSM atoll groundwater resource inventory

Problem and Research Objectives

Atoll islands are uniquely vulnerable to drought. During the severe droughts that accompany ENSO events, the western Pacific region can go for months without rain. At such times, water production from rooftop rain catchments, which supply the routine needs of island residents when rainfall is normal or abundant, ceases completely. Groundwater, which is the resource of last resort at such times, can become too saline for human consumption, or even disappear entirely as the shallow, thin groundwater lenses of the atoll islands become depleted. This is the first phase of a two-year project. The purpose of this phase is to collect and organize the information necessary to prepare to a state-of-the-art hydrological model to serve as a tool for planning, preparing, and responding effectively to recurring droughts. Specifically, such a model will provide reliable estimates of the amount of water that can likely be extracted under drought conditions before the potable groundwater supply is depleted, and the rate at which the freshwater lens can be expected to recover as precipitation returns to normal. Such knowledge will not only provide a basis for more effective management of emergency water supplies during droughts, but will also for sustainable management practices when rainfall is normal or abundant.

Methodology

This phase of the project included an initial search of the primary earth science bibliographical databases, construction of a comprehensive GIS data base on the atoll islands of the FSM, construction of a spreadsheet implementation of a simple analytical model of atoll hydrology, and a field reconnaissance visit to a representative atoll. Technical recommendations for development and protection of water resources must also be compatible with the island's social traditions, cultural values, and indigenous authority. The next phase of this project will therefore also include a survey of water usage habits and social and economic factors that govern or influence the use of groundwater, particularly during emergency conditions, on atoll islands in the FSM.

Principal Findings and Significance

The principal products of this phase of the project include a comprehensive bibliography of atoll island hydrology, a GIS database containing the basic areal, topographic, and all other available geographic, demographic, and hydrologic data for each atoll island in the FSM. In addition, we have constructed a spreadsheet model for making preliminary estimates of freshwater lens thickness based on estimated vertical and horizontal hydraulic conductivity and known or estimated rainfall. This model will provide the starting point for a more sophisticated numerical model of atoll island hydrology incorporating models for infiltration, evapotranspiration (ET), and recharge, and more realistic geology. Work is underway to refine the conceptual model based on the latest work and current understanding of atoll geology and the latest meteorological and hydrological data on atolls in the FSM. During an initial field visit to Ulithi Atoll, Yap State, in January 2006, the research team visited all four inhabited islands and four

additional uninhabited islands, some of which are used as “garden islands” to grow crops, and which accordingly have existing dug wells that can be brought into service when needed. The field team established working relationships with island leaders, including the managers and technicians of the water utilities and school teachers who have agreed to assist in collecting data on water production and consumption, as well as setting up a field station from which to collect data on evapotranspiration and well response to tidal forcing. Plans for the next phase include development of a SUTRA-based numerical model incorporating a model for infiltration based on soil moisture and ET conditions, and utilizing field data that will be collected by the team’s partners on Ulithi as well as during subsequent field visits during the coming year.